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ABSTRACT

The document presents unit plans which offer lists of experiences and competencies to be learned in the area of agricultural machinery for agribusiness, natural resources, and environmental occupations. The units include: (1) safety; (2) agricultural service center; (3) component parts--bearings, gears, pulleys, clutches, and others; (4) metal fasteners and sheet metal applications; (5) tillage and cultivation equipment; (6) plow; (7) farm sprayers; (8) grain drill; (9) corn planter; (10) mowers, conditioners, and swathers; (11) balers; (12) elevators; (13) combines; (14) corn pickers; (15) grain storage; (16) grain drying; (17) machinery painting, reconditioning, and set-up; (18) tractor hydraulics; (19) electric motors; (20) mechanization of waste management; (21) economics of agricultural machinery; (22) tool reconditioning; and (23) personal projects, evaluation periods, and current topics relative to needs of the local agricultural programs. The number of hours required for each unit are given. (EC)

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AGRICULTURAL MACHINERY

01.0301

For

Agribusiness, Natural Resources and Environmental Occupations

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AGRICULTURAL MACHINERY 01.0301

For

Agribusiness, Natural Resources, and Environmental Occupations

Exploratory occupational experiences provided are related to:

	D.O.T. Title	D.O.T. Code
1.	Farm equipment operator- - - - - - - - - -	409.883-010
2.	Machinery set-up man - - - - - - - - - - -	624.381-014
3.	Mechanics helper - - - - - - - - - - - - -	620.884-050
4.	Farm equipment mechanic, apprentice- - - -	624.281-010
5.	Mechanical maintenance man - - - - - - - -	620.281-074
6.	Greaser- - - - - - - - - - - - - - - - - -	624.884-010
7.	Farm manager - - - - - - - - - - - - - - -	409.168-010

General course competencies to accomplish:

1. To prepare a student for full-time employment in farming.
2. To prepare a student for entry levels into related agricultural mechanics occupations.
3. To explain the operating principles of component systems in agricultural machinery, i.e., cutting, conveying, threshing, processing and storage of agricultural crops and by-products.
4. Service, maintenance and calibration of agricultural machinery.
5. Service and maintenance of crop storage and drying equipment.
6. Service and maintenance of hydraulic components.
7. Service and maintenance of electric motors.
8. To calculate an economic analysis of machinery use and ownership.

AGRICULTURAL MACHINERY 01.0301

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Individualized Instruction

1) Researching a particular machine and prepare a demonstration for the class.

2) Determine machinery work units for a farming operation.

3) New developments and special machinery reports applicable to student's situation.

4) Present problems on machinery requirements for different production situations.

UNIT I. SAFETY (5 hours) -- Ability to . . .

A. Safety - Objectives
1. Outline general safety rules for all machines.
2. Demonstrate safe operation of specific machines and tools.
3. Discuss safe operation of tools and machinery before a group.

LESSON 1. Importance of farm machinery safety -- 1 hour
a. Know that age of operator is a factor in machinery accidents.
b. Recognize that time of day is a factor in machinery accidents.
c. Watch out for others.
d. Stop work if fatigued.
e. Realize that carelessness is a big factor in machinery accidents.
f. Always shut off a machine before performing service and maintenance jobs.
g. Not to allow extra riders.

LESSON 2. Safety Practices Common to All Farm Machinery Operations Such as Hitches, PTO, and Hydraulic Controls -- 1 hour
a. List rules related to safety on highways.
b. Correctly place reflection lights and SMV emblem on machinery.
c. Describe the effect of widening the rear wheels on the tractor by use of scale models.
d. Correctly install power guards and shields.
e. Explain the dangers of making turns near ditches, gullies or fences.
f. Correctly use the three-point hitch.
g. Describe the correct method of lifting a machine hitch to avoid back injury.
h. Identify safe hitch pins.

LESSON 3. Safety in Tillage Operations or Other Ground-Driven Equipment-1/2 hr.
a. Lower equipment to the ground when not in use, or to lock it in the "Transport" position when not in use.
b. Block up a machine if it must be worked on in a raised position.
c. Use SMV signs on all equipment when transporting on public road,
d. Never clean, lubricate, or adjust a machine while it is in motion.
e. Never ride, or permit others to ride on the drawbar of the tractor or equipment.

LESSON 4. Accident Causing Conditions -- 1/2 hour
a. List the more common causes of accidents in farm shop.
b. Develop a check list of inventory of safety factors to be used in rating his work shop at home.

LESSON 5. Proper Color Coding and Non-Skid Floor Abrasives -- 1/4 hour
a. Calculate the safety zone areas for a shop and determine where to apply the non-skid.
b. To apply color coding and non-skid in the home farm shop.

LESSON 6. Proper and Safe Use of Hand Tools -- 1/4 hour
a. Properly use hand tools.
b. Use the portable hand tools properly.

LESSON 7. Safe Use of Power Tools -- 1/2 hour
a. Properly use the power tools.
b. Use the power tools properly before being allowed to use them on his own.

LESSON 8. Selection of Electrical Tools and Their Use -- 1/4 hour

a. Identify the uses, construction and quality of electrical pliers, cutters, wire strippers, crimpers, and other tools.
b. Use several of the above tools in making splices, connections, testing, changing fuses, etc.

LESSON 9. Grounding of Electrical Equipment -- 1/4 hour

a. Be able to ground systems - using conduit, 2-wire with 3rd wire ground.
b. List how grounding systems protects operator from shock of faulty operating electrical equipment.
c. Ground an electrical circuit.
d. Ground an electric power tool when plugged into a non-grounded circuit.

LESSON 10. Safety -- 1/2 hour

a. List the dangers of working with electricity.
b. List the need for grounding.
c. Apply first aid to persons suffering from electrical shock.
d. List the need for disconnecting current when working on electrical equipment and wiring.
e. Make a test lamp.
f. Trouble shoot an electrical circuit.
g. Recognize a circuit which is grounded.
h. Treat persons in shock or those burned or suffering from electrical shock.
i. Recognize how polarity current behaves in the electrical system.

ACTIVITIES TO BE PERFORMED

1) Survey of present shop facility and analysis of same.
2) Institute or maintain color code program in school shop.
3) Show safety films.
4) Collect newspaper articles for period of time to stress safety.
5) Instructor may use liability statement as protection & promoting safety.
6) Bring out latest regulations on safety equipment.
7) Discuss OSHA applications to agriculture
8) Discuss OSHA applications to schools.

UNIT II. AGRICULTURAL POWER SERVICE CENTER (5 hours) -- Ability to . . .

A. Agricultural Power Service Center - Objectives

1. Identify by proper name the tools and equipment.
2. Be aware of potential danger areas in the shop.
3. Plan and organize an agricultural power service center.

LESSON 1. Planning the Agricultural Service Center -- 1 hour
a. List the facilities desired.
b. Calculate the size area needed and min. widths (60')
c. To sketch a building.

LESSON 2. Selection of Tools and Equipment -- 1 hour
a. Recognize tools and equipment.
b. List the capabilities to tools and equipment.
c. Write tool specifications.

LESSON 3. Selection of Supplies -- 1 hour
a. List and describe tools and supplies most frequently needed.
b. Prepare order list for herdware, lumber and other building materials.
c. Prepare a list of supplies needed.

LESSON 4. Principles and Use of Power tool Operation -- 1 hour
a. Manufacturer's manuals as to kinds of operations machines can perform.
b. Properly use each shop tool or machines.
c. Proper lubrication and adjustments needed before using equipment safely and efficiently.

LESSON 5. Repair of Equipment Used in the Service Center -- 1 hour
a. Replace or repair minor parts or pieces on equipment under direction of instructor and the manufacturer's hand books.
b. Know and use manufacturer's manuals before removing parts.
c. To recondition and order parts.

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ACTIVITIES TO BE PERFORMED

1) Evaluate student's shop and recommend improvements.
2) Plan a tool list for the agricultural service center.
3) Maintain school shop equipment whenever possible.
4) Plan a realistic service center for their own or hypothetical farm.
5) Prepare a list of expendable supplies for the agricultural service center.

UNIT III. COMPONENT PARTS OF MACHINERY (7 hours) -- Ability to . . .

A. Component Parts of Machinery
1. List components of machinery
2. Identify machinery components
3. Recognize when worn &/or broken.
4. Order replacement parts
5. Adjust and service component parts.
6. Lubricate machinery.

LESSON 1. Chains -- 1/2 hour
a. List types of chain.
b. Describe chain pitch.
c. Adjust chain.

LESSON 2. Gears -- 1/2 hour
a. Calculate gear ratio & speed.
b. Identify types of gears.

LESSON 3. Flexible Couplings and Friction Clutches -- 1 hour
a. Identify types of couplings.
b. Describe purpose of clutches.
c. Identify types of friction clutches.
d. To select the proper clutch for the job.

LESSON 4. Power Take Offs -- 1/2 hour
a. Trace power flow to power take-off.
b. Identify parts.
c. Install safety shields.
d. Lubricate universal joints.

LESSON 5. Belts, Bearings, and Pulleys -- 1/2/hour
a. Identify types of belts and pulleys.
b. Name parts of a bearing.
c. Lubricate bearings.
d. Select the correct bearing.

LESSON 6. Transmission -- 1 hour
a. Types of transmissions.
b. Identify parts of a synchronizer.
c. Sketch a planetary transmission.
d. Lubricate transmissions.

ACTIVITIES TO BE PERFORMED

1) Provide opportunities for students to properly adjust chains and belts.
2) Provide flash cards or samples of various types of chain, gears or belts for nomenclature and identification.
3) Develop ability of student to maintain and attach PTO equipment.
4) Be able to trace power train through manual transmission.

UNIT IV. METAL FASTENERS AND SHEET METAL (8 hours) -- Ability to . . .

A. Metal Fasteners and Sheet Metal

1. Identify all types of metal fasteners.
2. Use metal layout tools and cutting tools.
3. Fasten metal together.

LESSON 1. Bolts and Metal Screws -- 1 hour
a. Recognize the types of bolts and screws.
b. Recognize the types of nuts.
c. Recognize the types of threads.
d. To be able to order bolts and nuts.

LESSON 2. Riveting -- 1 hour
a. Recognize the different types of rivets.
b. Use the pop riveter.
c. Use hand riveting tools.
d. Order rivets for specific jobs.

LESSON 3. Soldering -- 1 hour
a. Discuss principles of soldering.
b. Identify type of fluxes and application of each.
c. Tin a soldering copper or gun tip.
d. Mechanically and chemically clean metal.

LESSON 4. Working With Sheet Metal -- 1 hour
a. Use a gage to determine size of sheet metal.
b. List how sheet metal is made and surface treated.
c. Selection of the proper gauge size of sheet metal for the job.

LESSON 5. Sheet Metal Measuring and Layout Tools -- 1 hour
a. Use the calipers and dividers in laying out sheet metal.
b. Determine sheet metal thickness using the micrometer and gages.

LESSON 6. Sheet Metal - Working Hand Tools -- 1 hour
a. Select and properly use a hacksaw and chisel in forming sheet metal.
b. Use tinner's snips to cut straight & curved lines in sheet metal manipulation.
c. Use the file & filing procedures which are appropriate for sheet metal work.

LESSON 7. Sheet Metal Working Machines -- 1 hour
a. Use the squaring shears and circle shears.
b. Use the folding and bending machines.
c. Identify various types of edges and folds and how they may be used,
d. Use the box and pan brake.

LESSON 8. Sheet Metal Layout and Pattern Design -- 1 hour
a. Be able to use patterns or templates.
b. Identify procedure for transfer of patterns.
c. Layout sheet metal patterns for a given sheet metal object from the given dimensions of the object.

UNIT IV. cont.

ACTIVITIES TO BE PERFORMED

1) Prepare an educational panel on metal fasteners.
2) Construct a small project (i.e. parts pan) involving different types of rivets and metal fasteners.
3) Develop the ability to distinguish the different hardnesses and strength of different types of metal bolts.

UNIT V. TILLAGE AND CULTIVATION EQUIPMENT (5 hours)-- Ability to . .

A. Tillage and Cultivation Equipment
   1. Identify tillage equipment.
   2. Operate, lubricate & adjust tillage equipment.
   3. Prepare equipment for off-season storage.

LESSON 1. Chisel Plows -- 1/2 hour
   a. Identify components of chisel plows.
   b. Describe advantages and disadvantages of chisel plows.

LESSON 2. Discs -- 1/2 hour
   a. Discuss types of discs for soil tillage.
   b. Identify advantages and disadvantages of discs for soil tillage.
   c. Identify component parts of discs.
   d. Locate, lubricate and maintain discs.

LESSON 3. Moldboard Plows -- 1/2 hour
   a. Identify moldboard plow components.
   b. Locate lubricating parts and properly lubricate the same.
   c. Discuss proper adjustments of moldboard plows.

LESSON 4. Rotary Hoes and Field Cultivators -- 1/2 hours
   a. Analyze the advantages and disadvantages of rotary hoes and field cultivators.
   b. Discuss principles of rotary hoes and field cultivators for weed control.

LESSON 5. Tractor Cultivators -- 1/2/ hour
   a. Discuss and describe the principles of tractor cultivators.
   b. Follow operators manual to properly use the equipment.

LESSON 6. Equipment Set-up and Operation -- 2 1/2 hours
   a. Follow operators manual to set-up a piece of equipment.
   b. Follow operators manual to properly use the equipment.

ACTIVITIES TO BE PERFORMED

1) Set up chisel or moldboard plow or another piece of machinery.
2) Properly adjust spacing of the piece of machinery, etc.
3) Field test the piece of machinery.
4) Develop the economics of ownership for the piece of machinery.

UNIT IV. PLOWS (6 hours) -- Ability to . . .

A. Plows
1. Identify parts of the plow.
2. Explain the operation of the plow components.
3. Hitch the plow to the tractor.
4. Operate, lubricate, and adjust the plow.

LESSON 1. Plows and Plowing -- 1/2 hour
a. Explain the purpose of plowing.
b. List root bed requirements.
c. List characteristics of a good plowing job.

LESSON 2. Plow selection, Identification of Parts and Safety -- 1 hour
a. List the different types of plows.
b. List the different types of plow shares.
c. Identify fundamental components of the plow.
d. List safe plow operational rules.

LESSON 3. Plow Fundamentals -- 2 hours
a. List operations of the plow.
b. List the functions of the various parts.
c. Explain safety bottom trips and safety hitch releases.
d. List the causes of poor scouring and proper care of bottoms.

LESSON 4. Plow Adjusting, Hitching and Storage -- 1/2 hour
a. Adjust proper rear wheel alignment.
b. List the procedure of proper vertical drawbar setting.
c. The procedure of proper horizontal drawbar and rear tractor wheel setting.
d. Adjust proper colter setting.
e. Properly prepare the plow for off-season storage.

LESSON 5. Hitching the plow -- 1 hour
a. List reasons for proper plow hitching
b. Calculate centers of resistance and pull.
c. Calculate proper wheel spacing on tractor.
d. Calculate proper wheel spacing and weighting of tractor.

LESSON 6. Adjusting and Hitching Worksheet -- 1 hour
a. Ability to read and interpret an operator's manual.
b. The ability to properly adjust and hitch a plow.

ACTIVITIES TO BE PERFORMED

1) Identify the various plow bottom types.
2) Identify parts and properly set a plow in field operation.
3) Follow a lubrication and maintenance procedure.
4) Be able to adjust a cultivator to crop and field conditions.

UNIT VII. FARM SPRAYERS (5 hours) -- Ability to . . .

A. Farm Sprayers
1. Identify the component parts of a sprayer.
2. Describe the function of each component part.
3. Calibrate a sprayer.
4. Make an economic analysis of spraying.
5. Service and maintenance of sprayers.

LESSON 1. Sprayer selection, Identification of Parts and Safety -- 1 hour
a. To select the proper size sprayer.
b. Identify fundamental parts of the sprayer.
c. Describe safe sprayer operation.

LESSON 2. Sprayer Fundamentals -- 1 hour
a. Describe basic operation of the sprayer.
b. Define the general functions of the various parts.
c. Identify the different types of nozzles and their proper use.
d. Stress the importance of nozzle and tank cleaning.

LESSON 3. Sprayer Calibration and Storage -- 1 hour
a. Define the procedures for setting ground speed.
b. Determine the procedures for setting sprayer outputs.
c. Outline proper mixing of spray material.
d. Calculate gallons applied per acre and amount of ingredients applied per acre.
e. Proper storage and its importance.

LESSON 4. Sprayer Calibration -- 1 hour
a. Calibration of actual sprayer.
b. Measure flow to check calibration of sprayer.

LESSON 5. Economic Importance -- 1 hour
a. Custom cost calculated by students.
b. Calculate difference between custom and farmer operated.
c. Calculate value for home farm.

ACTIVITIES TO BE PERFORMED

1) The ability to select nozzles for the specific job.
2) To detect nozzle wear.
3) Calibrate a sprayer for a typical field situation.
4) Identify pump types and associate with jobs to be accomplished.
5) Clean and maintain a sprayer for proper storage.
6) To know dangers involved when using various types of sprayers materials.

UNIT VIII. GRAIN DRILL (3 hours) -- Ability to . . .

A. Grain Drill
1. Economic analysis of grain drill ownership.
2. Identification of component parts and listing of the function of each.
3. Calibration, lubrication, adjustment, and operation.
4. Comparision of grain drills to other seeding machinery.

LESSON 1. Economics & Principles of the Different Types Grain Drill -- 1 hour
a. Recognize the factors in the selection of the grain drill.
b. Select the best grain drill for his productive unit.
c. List how the different types of grain drills operate.
d. Identify parts of the grain drill.
e. The purpose & functions of the various parts of the grain drill.
f. Compare grain drills to other seeding methods.

LESSON 2. Lubrication, Adjustment, and Calibration of the Grain Drill -- 1 hour
a. Determine the importance of becoming familiar with the contents of the operator's manual.
b. Properly lubricate the drill.
c. Adjust the drill.
de. Realize the importance of correct seeding thickness.
e. Calculate field size and bushels per acre planted.
f. Calibrate a grain drill for a desired bushel per acre.
g. Check the calibration of a grain drill.

LESSON 3. Safety, Seasonal Care and Special Attachments -- 1 hour
a. Prepare the drill for operation and operator's manual.
b. Realize the importance of safety procedure in the operation of the drill.
c. Select the proper seed opening.
d. Calibrate the fertilizer & grass seed attachments on the drill.

ACTIVITIES TO BE PERFORMED

1) Identify the various types of "feeds" of a grain frill.
2) Calibrate a grain drill to provide the proper population rates.
3) Properly clean, lubricate, and store a grain drill and order repair parts needed.
4) Perform maintenance on parts needing repair.

UNIT IX. CORN PLANTER (5 hours) -- Ability to . . .

A. Corn Planter
1. Economic analysis for the optimum size unit to own.
2. Identification of component parts and listing of the function of each.
3. Calibration, lubrication, adjustment and operation.
4. Evaluation of the different types of machine operating principles.

LESSON 1. Economics and Principles of the Corn Planter -- 1 hour
a. Describe the factors used in selection of the corn planter.
b. Select the best corn planter for production unit size.
c. Identify how the corn planter operates.
de Identify parts of the corn planter.
e. Recognize the purpose & function of the various parts of the corn planter.

LESSON 2. Lubrication and Adjustment of the Corn Planter -- 2 hours
a. Describe the contents of the service manual.
b. Properly lubricate the planter.
c. Adjust the corn planter.
d. Stress the importance of the service manual.

LESSON 3. Safety, Seasonal Care, and Special Attachments -- 1 hour
a. Describe the importance of safety procedures in the operation of the corn planter.
b. Prepare the planter for operation and use operator's manual
c. Select the proper seed plate.
d. Describe the special attachments of the corn planter.
e. Calibrate the fertilizer attachments & other attachments on the corn planter.

LESSON 4. Calculation of Corn Population & Calibration of the Corn Planter -- 1 hour
a. Stress the importance of correct corn population.
b. Calculate field size.
c. Calculate seed population per acre.
d. Calibrate a corn planter for a desired population per acre.
e. Check the calibration of the corn planter.

ACTIVITIES TO BE PERFORMED

1) Identify the different parts of a planter and attachments.
2) Calibrate the planter for specific crop conditions.
3) Lubricate, adjust, and maintain the planter following operator's manual.
4) Expose themselves to at least three different types of planters.
5) Determine field planting rate.

UNIT X. MOWERS, CHOPPERS AND STACKERS (6 hours) -- Ability to . . .

A. Mowers, Choppers and Stackers
1. Recognition of the different types of equipment on the market.
2. Identification of the component parts of each machine and listing of the function of each.
3. Calibration, lubrication, adjustment and operation.
4. Hay handling systems.

LESSON 1. Mower Selection, Identification of Parts and Safety -- 1 hour
a. Discuss the advantages of the different types of mowers.
b. Identify fundamental component parts of the mower.
c. Identify safe mower operation.

LESSON 2. Mower Fundamentals -- 1 hour
a. Determine the basic operations of the mower.
b. Discuss general functions of the various component parts.
c. Discuss the relationship of the mower units to each other.

LESSON 3. Mower Adjustment and Storage -- 1 hour
a. Properly hitch.
b. Identify proper tilt bar setting.
c. Identify proper guard & knife holder.
d. Identify proper lead of knife.
e. Identify register of knife.
f. Identify proper storage & its importance.

LESSON 4. Forage Equipment Including Mowers, Hay Conditioners, Forage Harvesters Shredders and Silo Fillers -- 2 hours
a. Recognize need to shut off the power when cleaning, lubricating, & adjusting or unclogging.
b. Identify safe and unsafe situations for starting the machine.
c. Identify slip clutches or safety releases.
d. Recognize when safety shields are properly installed.
e. Describe proper types of clothing to wear.

LESSON 5. Hay Conditioners, Forage Harvesters, Swatters, Adjustment and Fundamentals -- 1 hour
a. Determine basic operational uses for machinery in your area.
b. Discuss advantages and disadvantages to the use of a particular machine in field operation.
c. Identify proper storage & its importance.
d. Identify proper setting and maintance of machines.

ACTIVITIES TO BE PERFORMED

1) Collect commercial literature depicting four different types of mower drives.
2) Understand adjustments such as lead, lag, and register, bar tilt, proper hitching and apply it to a particular unit.
3) Point out differences between hay crushers and crimpers.
4) Avail themselves to different field operations involving: stackers, conditioning, shreaders and forage harvesters.

UNIT XI. BALERS (6 hours) -- Ability to . . .

A. Balers
1. Identification of the component parts of each machine and listing of the function of each.
2. Calibration, lubrication, adjustment and operation.
3. Evaluation of the different hay handling systems.

LESSON 1. Baler Selection, Ownership and Safety -- 1 hour
a. Identify the types of machines and methods of haying.
b. Identify the principles of machine selections.
c. Determine depreciation.
d. Determine fixed and variable cost.
e. Identify safe machine operation.

LESSON 2. Identification of Parts -- 1 hour
a. Identify fundamental component parts of the baler.
b. Identify general functions of the various parts.
c. Determine the relationship of the baler units to each other.

LESSON 3. Operation and Adjustment of the Baler -- 2 hours
a. Identify the basic operations of the baler.
b. Determine adjustments made for crooked bales.
c. Determine knife sharpening and clearance.
d. Recognize appearance of twine when different adjustments are needed on the knotter.
e. Adjust, needles, tension, slip clutch, and pick-up properly.

LESSON 4. Baler Fundamentals -- 1 hour
a. Discuss the feeding failures and corrections.
b. Determine the plunger clearance.
c. Discuss the operation of the knotter.
d. Determine the importance of sharpening the twine knife & adjustments.

LESSON 5. Lubrication, Storage and Optional Equipment -- 1 hour
a. The importance of proper lubrication.
b. The need for a lubrication program using the proper lubricants.
c. Understand the importance of & implementing a complete storage procedure for the baler.
d. Proper use of dual wheels, an engine, and bale throwers.

ACTIVITIES TO BE PERFORMED

1) Identify major parts.
2) Check the "timing" of a baler.
3) Check the common wear points of a baler.
4) Make a proper square knot.
5) Know how to lubricate and adjust the baler for various operating conditions.
6) Adjust tension according to field conditions.
7) Point out safety practices and features of a baler.
8) Expose themselves to various hay stacking equipment.

UNIT XII. ELEVATORS (2 hours) -- Ability to . . .

A. Elevators
1. Identify the different conveying systems.
2. Lubricate, adjust and operate the units.
3. Selection of the proper system for the job.
4. Listing of safety rules.
5. Selection of power units for elevators.

LESSON 1. Augers, Conveyors and Portable Elevators - 1 hour

a. Keep hands out of access holes in sides of elevator when in operation.
b. Carry the weight of the elevator on the cables rather than on the safety stops.
c. Beware of obstructions, or electric wires when raising or lowering the elevator.
d. Support the head of the elevator when operating the elevator at low elevations to avoid tipping.
e. Never clean, lubricate or adjust the machine while in operation.
f. Keep all guards in place.
g. Use the proper way to adjust the tension on hopper springs for easy lifting by means of a demonstration.

LESSON 2. Flight Conveyors (elevators) Capacity Determinations -- 1 hour

a. Describe the types of conveyors.
b. Explain the factors influencing the capacity of conveyors.
c. Select power units for conveyors.
d. Determine the capacity for conveyor unit.

ACTIVITIES TO BE PERFORMED

1) Adjust chain tension.
2) Observe safety operations when moving an elevator.
3) Be able to change a link on an elevator chain.
4) Perform preventative maintenance on an elevator.

UNIT XIII. COMBINES (12 hours) -- Ability to . . .

A. Combines
1. Identification of the component parts & listing of the function of each.
2. Calibration, lubrication, adjustment and operation.
3. Economic analysis of different sized units.
4. Listing of combine safety rules.

LESSON 1. Combine Operation (movie) -- 1 hour
a. Identify the operations of a combine.

LESSON 2. Combine Operation (field trip) -- 1 hour
a. Identify field losses.
b. Calculate field losses.

LESSON 3. Combine Design -- 1 hour
a. Identify combine component parts.

LESSON 4. Parts Identification -- 1/2 hour
a. Identify component parts on the combine.

LESSON 5. Combine Power Flow -- 1/2/ hour
a. Adjust & identify tachometer speeds, pulleys and gears.

LESSON 6. Combine Cutting Systems and Adjustments -- 1/2 hour
a. Describe and adjust various cutting systems.

LESSON 7. Combine Threshing Systems and Adjustments -- 1/2 hour
a. Describe & adjust various threshing systems.

LESSON 8. Combine Separating Systems and Adjustments -- 1/2 hour
a. Discuss and adjust combine separating systems.

LESSON 9. Combine Conveying Systems and Adjustments - 1/2 hour
a. Describe & adjust combine conveying systems.

LESSON 10. Combine Corn Head Adjustments and Systems -- 1/2 hour
a. Identify and adjust corn head components.
b. List steps in corn head installation and maintenance.

LESSON 11. Combine Hydraulic Systems -- 1/2 hour
a. Identify component parts of combine hydraulic systems.
b. Discuss proper hydraulic liquids use and maintenance.

LESSON 12. Combine Engine Service and Maintenance -- 1/2 hour
a. Discuss proper engine service and maintenance procedures.

LESSON 13. Combine Lubricating -- 1/2 hour
a. Locate areas of lubrication.
b. Identify proper lubrication methods and materials to use.

LESSON 14. Calculating combine losses -- 1/2 hour
a. Identify areas of losses.
b. Determine methods of calculating losses.

LESSON 15. Combine Field Losses -- 1 hou4
a. Recognize degrees of field losses.
b. Locate areas of field losses.

XIII. cont.

LESSON 16. Loss Reduction -- 1/2 hour
a. Determine proper adjustments for minimum losses.
b. Calculate proper ground speeds.
c. Determine losses due to moisture content.
d. Calculate per cent loss of total yield.

LESSON 17. Economics of Grain Sales -- 1/2 hour
a. Calculate the sales reduction due to damaged grain.

LESSON 18. Economics of Machine Selection -- 1 hour
a. Determine feasibility of combine size in relation to acreage.

LESSON 19. Ownership Depreciation, Variable and Fixed Costs -- 1 hour
a. Determine the various costs of combine ownership.

ACTIVITIES TO BE PERFORMED

1) Identify causes for various harvesting losses.
2) Compute harvesting losses for specific field conditions and for different crops.
3) Compare annual cost of ownership vs. custom operation using combines on their own or a simulated farm operation.
4) Have students individually operate a combine and make adjustments to alleviate harvesting losses.
5) Trace the drive train of a specific combine.

UNIT XIV. CORN PICKER (5 hours) -- Ability to . . .

A. Corn Picker
1. Identify the component parts and list the function of each.
2. Calibration, lubrication, adjustment and operation.
3. Economic analysis of ownership.
4. Listing corn picker operation safety rules.

LESSON 1. Operating Principles of Corn Harvesting Equipment -- 1 hour
a. List operation and function of corn harvesting equipment.
b. Identify basic machines and mechanical principles that are found in corn harvesting equipment.
c. Identification of the basic parts & mechanisms typical of most corn harvesters.

LESSON 2. Proper Adjustment of Corn Harvesting Equipment -- 1 hour
a. Properly adjust corn harvesting equipment.

LESSON 3. Lubrication of Corn Harvesting Equipment -- 1 hour
a. Realize the importance of proper lubrication of corn harvesting equipment.
b. Properly lubricate corn harvesting equipment.

LESSON 4. Maintenance and Servicing Corn Harvesting Equipment -- 1/2 hour
a. Properly service and maintain corn harvesting equipment.
b. To service & maintain equipment in such a manner that major breakdowns will be minimized.

LESSON 5. Prepare Corn Harvesting Equipment for Winter Storage -- 1/2 hour
a. Properly prepare corn harvesting equipment for off-season storage.

LESSON 6. Safe Operation of Corn Harvesting Equipment -- 1 hour
a. Follow good safety practices in preventing accidents.
b. Operate corn harvester safely.

ACTIVITIES TO BE PERFORMED

1) Perform safety demonstration on PTO, snapping, and husking bed.
2) Have safety engineer talk on picker safety.
3) Thoroughly go through adjustment, maintenance, and lubrication of a corn picker.
4) Set machine according to specific crop and field conditions.
5) Calculate field losses.

UNIT XV. GRAIN STORAGE (5 hours) -- Ability to . . .

A. Grain Storage

1. Identify the different types of grain storage systems.
2. Identify the component parts and list the function of each.
3. Determine grain storage needs.
4. Economic analysis of grain storage.

LESSON 1. Grain Storage Facilities -- 1 hour
a. Determine adequate storage requirements.
b. Discuss and identify different storage facilities.

LESSON 2. Component Selection -- 1 hour
a. Select matching components and system patterns for grain storage.

LESSON 3. Flow Rates -- 1 hour
a. Describe terminology of sizing flow rates.
b. Describe and discuss various equipment for uses in calculating flow rates for grain storage.

LESSON 4. Tour of Grain Storage Facilities -- 2 hours
a. Application of principles taught.
b. Start to

ACTIVITIES TO BE PERFORMED

1) Compute cubic contents of a bin or structure.
2) Treat a grain storing facility for pests.
3) Plan a grain storage system for the home, farm or for a theoritical farm.

UNIT XVI. GRAIN DRYING (8 hours) -- Ability to . . .

A. Grain Drying
1. Evaluation of the different drying systems.
2. Identification of the component parts and listing of the function of each.
3. Economic analysis of drying vs. non-drying of crops.

LESSON 1. Drying Methods -- 1 hour
a. Discuss and identify various grain drying methods.
b. Select the drying methods best suited to each crop.

LESSON 2 & 3 Characteristics of Drying Methods -- 2 hours
a. Discuss and identify factors influencing drying methods.
b. Identify fuel and power, air flow, heat input drying temp. as factors to consider when drying.

LESSON 4. Preformance Relationships -- 2 hours
a. Determine air flow rates and drying temp. for different drying methods.

LESSON 5. Choosing the Drying Methods -- 1 hour
a. Discuss advantages and disadvantages of the different drying methods.
b. Chemical"drying".

LESSON 6. Tour of Grain Drying Equipment and Facilities -- 2 hours
a. Application of principles taught.

ACTIVITIES TO BE PERFORMED

1) Students compare different drying facilities for their own or a simulated farm.
2) Demonstrate moisture testing.
3) Visit a modern grain drying facility.
4) Perform a cost analysis for drying a specific crop.

UNIT XVII. MACHINERY PAINTING, RECONDITIONING, AND SET-SUP (5 hours) -- Ability to . . .

A. Machinery Painting, Reconditioning and Set-up.

1. Selection of the correct paint or protective material for a specific job.
2. Apply point and other protective materials.
3. Use of paint sprayers, grinders, sanders, etc.

LESSON 1. Kinds of Paints, Selection, Mixing and Use of Brushes -- 2 hours
a. Recognize differences in paint.
b. Mix paint properly.

LESSON 2. Preparing New and Old Surfaces, Primers and Application of Paints -- 1 hour
a. Prepare surface and use of primers.
b. Apply paint properly.

LESSON 3. Cutting Glass and Glazing Windows -- 1 hour
a. Glaze a window.
b. Cut glass to fit size of window.
c. Install a glass pane.

LESSON 4. Lab -- 1 hour
a. Mix paint to obtain desired color.
b. Painting of projects.
c. Clean and store paint brushed.

ACTIVITIES TO BE PERFORMED

1) Prepare a particular machine for painting.
2) Bring in at least one implement for complete reconditioning including ordering parts, proper installation, and adjustment (involving torque wrench, etc.)
3) Prepare a display of different protective coating materials.
4) Replace a window pane.

UNIT XVIII. TRACTOR HYDRAULICS (5 hours) -- Ability to . . .

A. Tractor Hydraulics

1. Identification of the component parts of a hydraulic system and listing of the function of each.
2. Work problems on the mathematics of hydraulics.
3. Service of a hydraulic system.
4. Changing filters and fluid.
5. Make minor repairs on the pumps and cylinders.

LESSON 1. Hydraulic Principles -- 1 hour
a. Work problems involving Pascal's Principles.

LESSON 2. Hydraulic Fluids -- 1 hour
a. List the types of hydraulic fluids.
b. Outline the applications for the different fluids.
c. Change oil in a hydraulic system.

LESSON 3. Controls and Valves -- 1 hour
a. Identify the different valves.
b. Identify various parts and controls.

LESSON 4. Hydraulic Cylinders -- 1 hour
a. List types of hydraulic cylinders.
b. Select appropriate cylinders.
c. Identify important parts of cylinders.

LESSON 5. Filters, Lines, Connectors -- 1 hour
a. Identify the types of connectors and lines.
b. Install pipe, tubing and flex hose.

ACTIVITIES TO BE PERFORMED

1) Show movies on hydraulics from Denison Company.
2) Show IH film strips on hydraulics.
3) Work problems on hydraulics.
4) Maintain at least one tractor hydraulic system.
5) Rotate students to lab areas to work on:

a) rotery pump b) gear pump c) power steering unit d)hydraul
d) hydraulic e) flow divider f) hydraulic cooler and hose
g) tractor hydro-drive system samples

UNIT XIX. ELECTRIC MOTORS (7 hours) -- Ability to . . .

A. Electric Motors
1. Identify the different types of motors.
2. Ability to lubricate and clean an electric motor.
3. Selection of motors for specific jobs.
4. Explain how a motor operates.
5. Determine over current protection requirements.
6. Determine switching devices for controlling motors.

LESSON 1. How do Electric Motors Start and Run?-- 1 hour
a. Discuss the purpose of permanent and electromagnets.
b. Discuss how an electro-magnetic stator and rotor are made into a simple motor.
c. Identify parts of induction run motors used on farms.
d. Determine what makes an electric motor run.
e. Identify how the following types of electric motors start and run: splitphase, capacitor start, series (Universal), repulsion start induction and shaded pole motors.

LESSON 2. Parts of an Electric Motor -- 1 hour
a. Identify parts of motor.
b. Explain how an electric motor operates.
c. Reverse an electric motor.
d. Change an electric motor from 120 to 240 volts.

LESSON 3. Motors for Light Starting Loads -- 1 hour
a. Sketch current flow in a split phase motor.
b. Test the starting amp requirements.

LESSON 4. Motors for Moderate Starting Loads -- 1 hour
a. Outline the operating principle of the capacitor-start motors.
b. Describe the wiring of a three-phase motor.

LESSON 5. Motors for Heavy Starting Loads -- 1 hour
a. Explain starting circuit of a repulsion-start induction run motor.
b. List advantages of a capacitor-start capacitor run motor.

LESSON 6. Selection Factors -- 1 hour
a. Type of electric service and motor selection.
b. Identify type of motor enclosure, mounts, bearings, & lubrication systems.

LESSON 7. General Maintenance and Motor Service -- 1 hour
a. Determine conditions which reduce the effective life of a motor.
b. Determine when a motor needs service.
c. Adjust proper belt tension.
d. Do a continuity check.
e. Properly lubricate a motor.
f. Check the quality of motor windings.

ACTIVITIES TO BE PERFORMED

1) Select the proper motor for the job.
2) Clean an electric motor and properly lubricate.
3) Know how to compute belt size.
4) Select proper wire and fuse size.
5) Reverse and electric motor.
6) Change a motor from 120 to 240 volts.

UNIT XX. MECHANIZATION OF WASTE MANAGEMENT (8 hours) -- Ability to . . .

A. Mechanization of Waste Management

1. Sketch the different types of waste mgt. systems.
2. Explain how each waste mgt. system works.
3. Review the state pollution control agency regulations.
4. Service & operate the necessary waste handling machinery.

LESSON 1. Principles of Waste Management -- 1 hour
a. Identify waste disposal problems.
b. Discuss and identify land saturation points.

LESSON 2. Environmental factors of waste disposal -- 1 hour
a. Identify potential environmental problems with increased waste disposal.
b. Discuss and identify state laws regarding disposal.

LESSON 3. Methods of Waste Disposal -- 1 hour
a. Identify various methods of disposing of manure.

LESSON 4. Liquid Manure Handling -- 1 hour
a. Identify various machinery requirements for this system.
b. Recognize safety precautions.
c. Adjust liquid manure spreaders.

LESSON 5. Solid Manure Handling -- 1 hour
a. Identify machinery requirements.
b. Recognize safety precautions.
c. Adjust and maintain solid manure spreaders.

LESSON 6. Tour of Community Facilities -- 3 hours
a. Application of principles taught.

ACTIVITIES TO BE PERFORMED

1) With the help of SCS personnel develop a satisfactory pollution control program for a particular farm.

2) Determine the cost of different waste handling systems.

UNIT XXI. ECONOMICS OF AGRICULTURAL MACHINERY (10 hours) -- Ability to . . .

A. Economics of Agricultural Machinery

1. Analysis of specific systems to provide for economic production.
2. Analysis of ownership vs. rental or custom hiring of specific production operations.

LESSON 1. Principles of Intelligent Purchase of Replacement of Farm Equipment

a. Using University of Minnesota fact sheets go through simulated problem on farm machinery selection.
b. Develop a budget for a typical farming situation.
c. Know how to use the different depreciation schedule methods.
d. Expose students to farm capitol out lay deductions.

ACTIVITIES TO BE PERFORMED

1) Work economic analysis problems for the home, farm or a simulated problem.
2) Visit a bank, P.C.A. or other loan agency.
3) Visit a machinery assembly plant.
4) Visit a machinery research center.

UNIT XXII. TOOL RECONDITIONING (5 hours) -- Ability to . . .

A. Tool Reconditioning

1. Recognize repairs needed.
2. Sharpen tools.
3. Replace handles.
4. Replace electrical cards.
5. Perform other minor repairs.

LESSON 1. Economic Importance of Tool Reconditoning -- 1 hour
a. Judge the value of a tool for reconditioning.
b. Determine the equipment needed in the service center.

LESSON 2. Tool Repair -- 1 hour
a. List methods of repair.
b. Know how to re-temper metal.
c. List equipment needing repair.
d. Sharpen tools.
e. Replace handles.

LESSON 3. Tool Sharpening -- 1 hour
a. Sharpen twist drill bit, chisels, etc.

ACTIVITIES TO BE PERFORMED

1) Clean and recondition and inventory all tools in school shop.
2) Perform maintenance on all power equipment in farmsshop.
3) Recondition tools brought from home.
4) Develop a service and maintenance schedule for the home, farm and/or service center.

UNIT XXIII. PERSONAL PROJECTS (44 hours) -- Ability to . . .

A. Personal Projects

1. Assemble machinery.
2. Make minor repairs.
3. Lubricate, calibrate, and operate machines.

LESSON 1. Working on Machinery
a. Related to topic being studied.

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